





## TFT LCD Approval Specification

# MODEL NO.: N154I3-L01

Customer : Fujitsu

Approved by : \_\_\_\_\_

Note :

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval
	

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**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver 3.0	Jan.25, 2006	All	All	Approval specification was first issued.

**1. GENERAL DESCRIPTION****1.1 OVERVIEW**

N154I3 -L01 is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1280 x 800 Wide-XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

## 1.2 FEATURES

- Thin and light weight
- WXGA (1280 x 800 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock

## 1.3 APPLICATION

- TFT LCD Notebook

## 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	331.2 (H) x 207.0 (V) (15.4" diagonal)	mm	(1)
Bezel Opening Area	335.0 (H) x 210.7 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.2588 (H) x 0.2588 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25)	-	-

## 1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	343.5	344.0	344.5	mm	(1)
	Vertical(V)	221.5	222.0	222.5	mm	
	Depth(D)	-	6.2	6.5	mm	
Weight		-	510	530	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

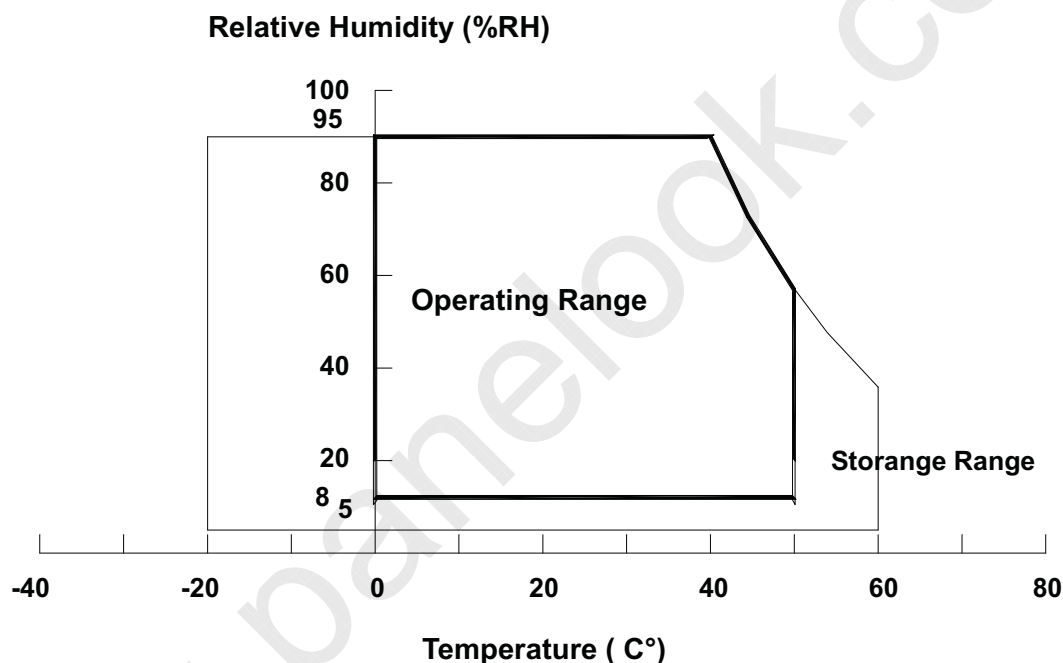
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T <sub>ST</sub>	-20	+60	°C	(1)
Operating Ambient Temperature	T <sub>OP</sub>	0	+50	°C	(1), (2)
Shock (Non-Operating)	S <sub>NOP</sub>	-	200/2	G/ms	(3), (5)
Vibration (Non-Operating)	V <sub>NOP</sub>	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 95 %RH Max. ( $T_a \leq 40\text{ }^{\circ}\text{C}$ ).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40\text{ }^{\circ}\text{C}$ ).

(c) No condensation.



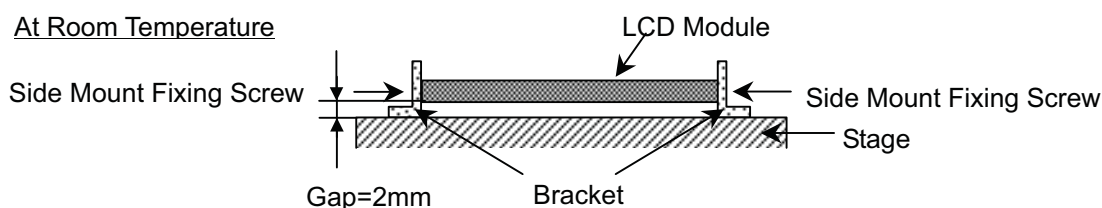
Note (2) The temperature of panel surface should be 0 deg C Min. and 50 deg C Max.

Note (3) 1 time for  $\pm X, \pm Y, \pm Z$ . for Condition (200G / 2ms) is half Sine Wave,.

Note (4) 10~200 Hz, 0.5hr/cycle 1cycle for X,Y,Z

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V <sub>CC</sub>	-0.3	+4.0	V	(1)
Logic Input Voltage	V <sub>IN</sub>	-0.3	V <sub>CC</sub> +0.3	V	

### 2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V <sub>L</sub>	-	2.5K	V <sub>RMS</sub>	(1), (2), I <sub>L</sub> = 6.5 mA
Lamp Current	I <sub>L</sub>	2	7.0	mA <sub>RMS</sub>	(1), (2)
Lamp Frequency	F <sub>L</sub>	50	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

### 3. ELECTRICAL CHARACTERISTICS

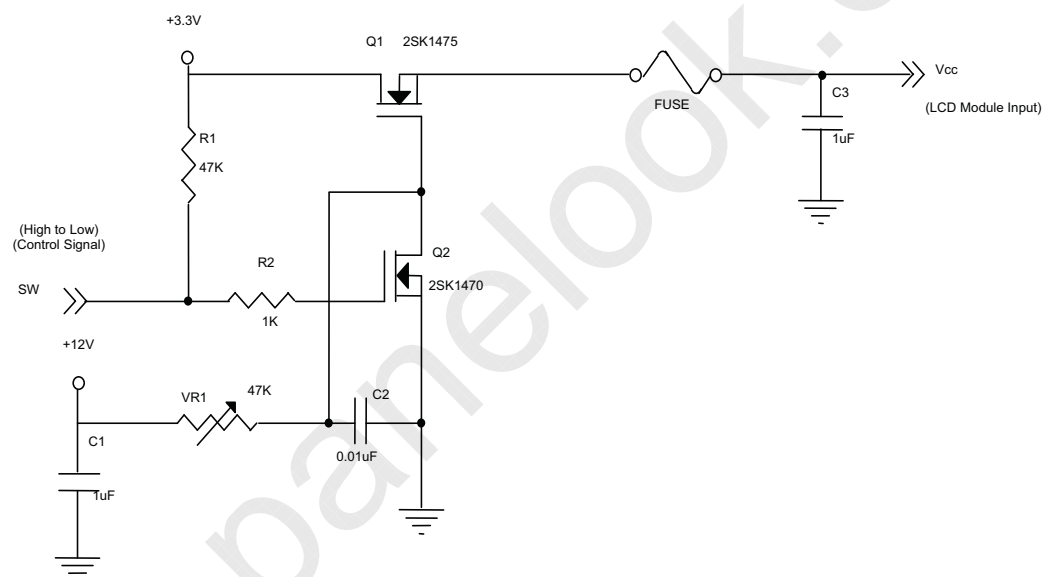
#### 3.1 TFT LCD MODULE

 $T_a = 25 \pm 2^\circ\text{C}$ 

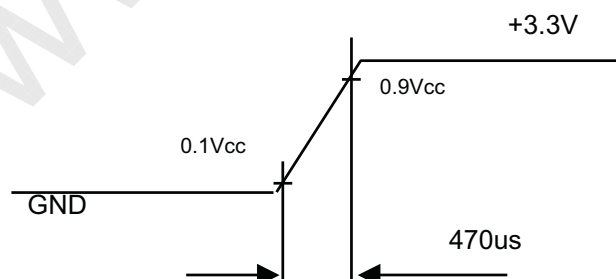
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	$V_{CC}$	3.0	3.3	3.6	V	-
Ripple Voltage	$V_{RP}$	-	-	100	mV	-
Rush Current	$I_{RUSH}$	-	-	1.5	A	(2)
Power Supply Current	White	-	300	350	mA	(3)a
	Black	-	350	400	mA	(3)b
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	-	-	+100	mV	-
	"L" Level	-100	-	-	mV	-
Terminating Resistor	$R_T$	-	100	-	Ohm	-

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



**Vcc rising time is 470us**



Note (3) The specified power supply current is under the conditions at  $V_{cc} = 3.3\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ , DC Current and  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area



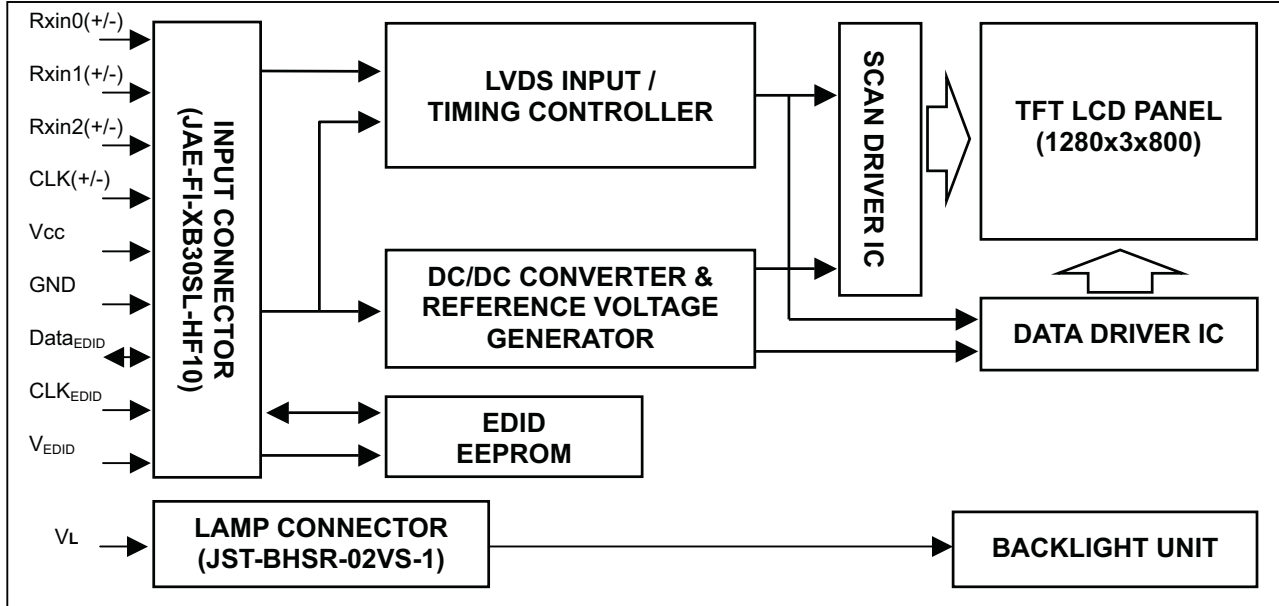
## 3.2 BACKLIGHT UNIT

 $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$ 

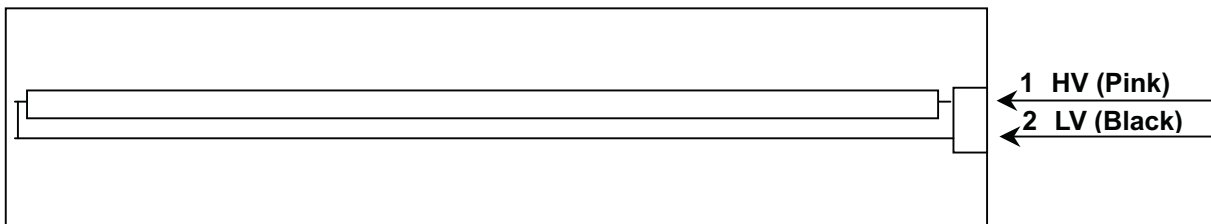
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	$V_L$	585	650	715	$V_{RMS}$	$I_L = 6.0 \text{ mA}$
Lamp Current	$I_L$	2.0	6.0	6.5	$\text{mA}_{RMS}$	(1)

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



### 4.2 BACKLIGHT UNIT



## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		-
2	Vcc	Power Supply +3.3 V		-
3	Vcc	Power Supply +3.3 V		-
4	V <sub>EDID</sub>	DDC +3.3 V		-
5	NC	-	-	-
6	CLK <sub>EDID</sub>	DDC Clock		-
7	Data <sub>EDID</sub>	DDC Data		-
8	Rxin0-	LVDS Differential Data Input	Negative	-
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		-
11	Rxin1-	LVDS Differential Data Input	Negative	-
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		-
14	Rxin2-	LVDS Differential Data Input	Negative	-
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		-
17	CLK-	LVDS Clock Data Input	Negative	-
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		-
20	NC	-	-	-
21	NC	-	-	-
22	NC	-	-	-
23	NC	-	-	-
24	NC	-	-	-
25	NC	-	-	-
26	NC	-	-	-
27	NC	-	-	-
28	NC	-	-	-
29	NC	-	-	-
30	NC	-	-	-

Note (1) Connector Part No.: JAE-FI-XB30SL-HF10 or equivalent

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent

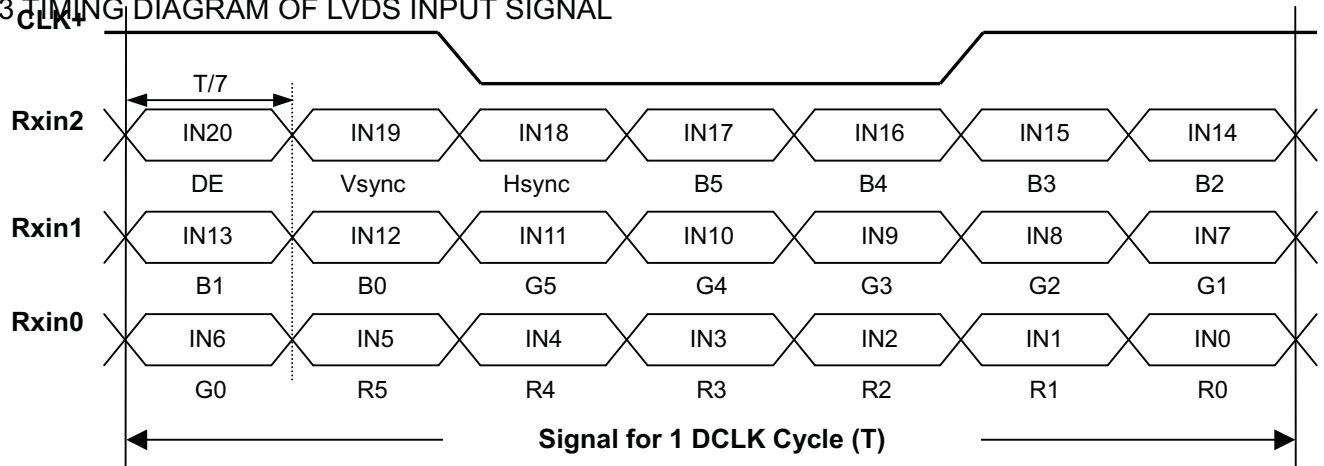
## 5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	Pink
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

## 5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



#### 5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD I standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N154I3-L01)	25	00100101
11	0B	ID product code (hex LSB first; N154I3-L01)	15	00010101
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed "00H")	00	00000000
17	11	Year of manufacture (fixed "00H")	00	00000000
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("33cm")	21	00100001
22	16	Max V image size ("21cm")	15	00010101
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	1C	00011100
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	A5	10100101
27	1B	Red-x (Rx = "0.598")	99	10011001
28	1C	Red-y (Ry = "0.337")	56	01010110
29	1D	Green-x (Gx = "0.323")	52	01010010
30	1E	Green-y (Gy = "0.523")	86	10000110
31	1F	Blue-x (Bx = "0.150")	26	00100110
32	20	Blue-y (By = "0.127")	20	00100000
33	21	White-x (Wx = "0.313")	50	01010000
34	22	White-y (Wy = "0.329")	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001

39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("71MHz", According to VESA CVT Rev1.1)	BC	10111100
55	37	# 1 Pixel clock (hex LSB first)	1B	00011011
56	38	# 1 H active ("1280")	00	00000000
57	39	# 1 H blank ("160")	A0	10100000
58	3A	# 1 H active : H blank ("1280 : 160")	50	01010000
59	3B	# 1 V active ("800")	20	00100000
60	3C	# 1 V blank ("23")	17	00010111
61	3D	# 1 V active : V blank ("800 :23")	30	00110000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("32")	20	00100000
64	40	# 1 V sync offset : V sync pulse width ("3 : 6")	36	00110110
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48: 32 : 3 : 6")	00	00000000
66	42	# 1 H image size ("331 mm")	4B	01001011
67	43	# 1 V image size ("207 mm")	CF	11001111
68	44	# 1 H image size : V image size ("331 : 207")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N154I3-L01", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of name ("N")	4E	01001110
78	4E	# 2 2nd character of name ("1")	31	00110001
79	4F	# 2 3rd character of name ("5")	35	00110101
80	50	# 2 4th character of name ("4")	34	00110100
81	51	# 2 5th character of name ("I")	49	01001001
82	52	# 2 6th character of name ("3")	33	00110011
83	53	# 2 7th character of name ("-")	2D	00101101

84	54	# 2 8th character of name ("L")	4C	01001100
85	55	# 2 9th character of name ("0")	30	00110000
86	56	# 2 9th character of name ("1")	31	00110001
87	57	# 2 New line character indicates end of ASCII string	0A	00001010
88	58	# 2 Padding with "Blank" character	20	00100000
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("C")	43	01000011
96	60	# 3 2nd character of string ("M")	4D	01001101
97	61	# 3 3rd character of string ("O")	4F	01001111
98	62	# 3 New line character indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with "Blank" character	20	00100000
100	64	# 3 Padding with "Blank" character	20	00100000
101	65	# 3 Padding with "Blank" character	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FE (hex) defines ASCII string (Model Name "N154I3-L01", ASCII)	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("N")	4E	01001110
114	72	# 4 2nd character of name ("1")	31	00110001
115	73	# 4 3rd character of name ("5")	35	00110101
116	74	# 4 4th character of name ("4")	34	00110100
117	75	# 4 5th character of name ("I")	49	01001001
118	76	# 4 6th character of name ("3")	33	00110011
119	77	# 4 7th character of name ("-")	2D	00101101
120	78	# 4 8th character of name ("L")	4C	01001100
121	79	# 4 9th character of name ("0")	30	00110000
122	7A	# 4 9th character of name ("1")	31	00110001
123	7B	# 4 New line character indicates end of ASCII string	0A	00001010
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	49	01001001



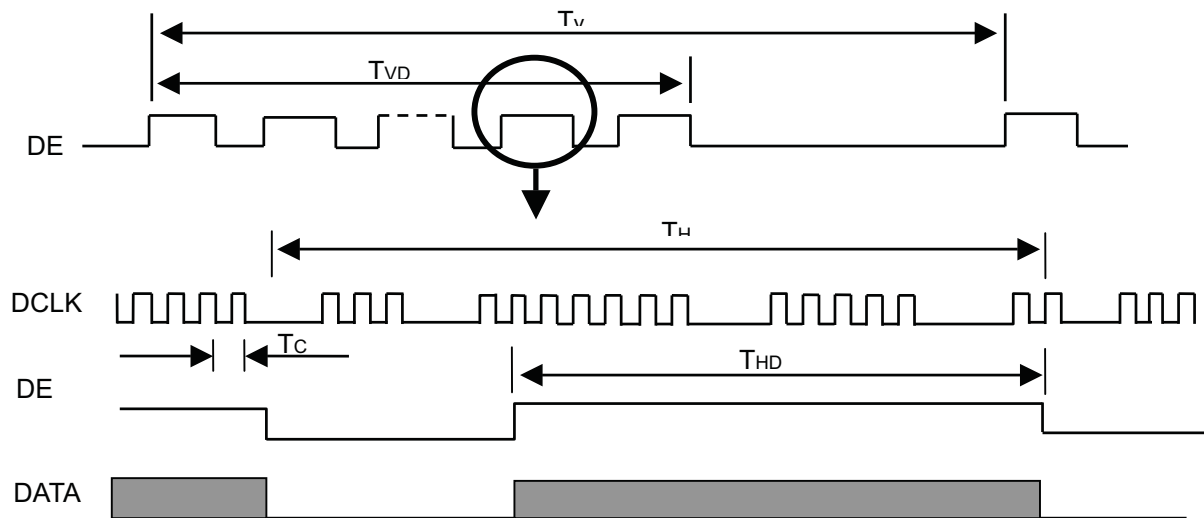
## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

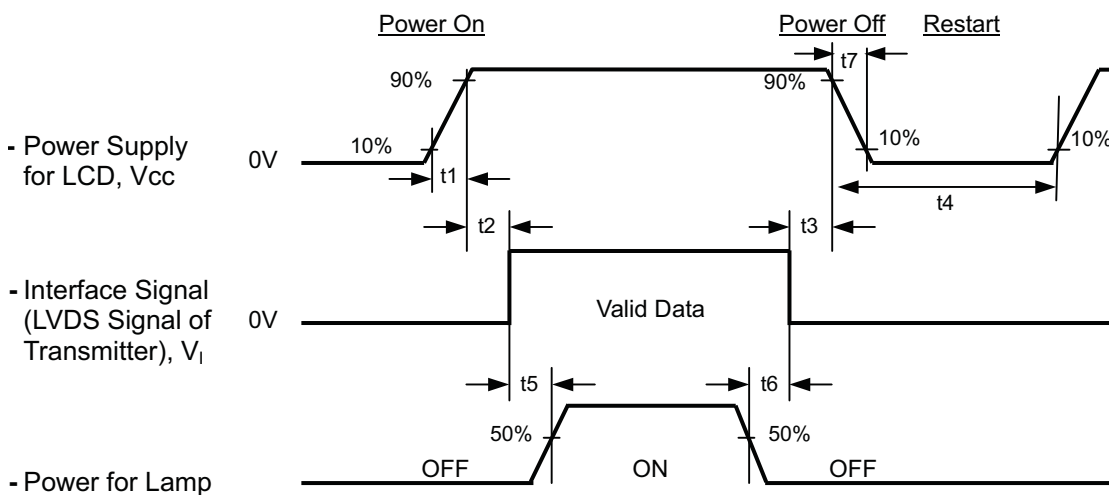
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	-	71	80	MHz	-
DE	Vertical Total Time	TV	810	823	(1000)	TH	-
	Vertical Addressing Time	TVD	800	800	800	TH	-
	Horizontal Total Time	TH	1360	1440	(1600)	Tc	-
	Horizontal Addressing Time	THD	1280	1280	1280	Tc	-

#### INPUT SIGNAL TIMING DIAGRAM



### 6.2 POWER ON/OFF SEQUENCE



## Timing Specifications:

$$0.5 < t_1 \leq 10 \text{ msec}$$

$$0 < t_2 \leq 50 \text{ msec}$$

$$0 < t_3 \leq 50 \text{ msec}$$

$$t_4 \geq 500 \text{ msec}$$

$$t_5 \geq 200 \text{ msec}$$

$$t_6 \geq 200 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time had better to follow

$$t_7 \geq 5 \text{ msec}$$

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

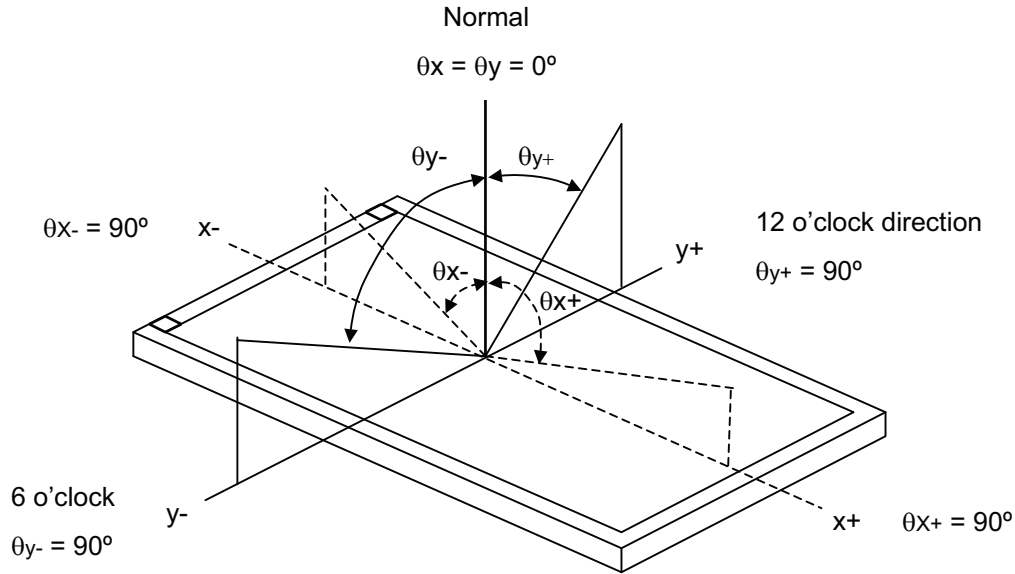
Item	Symbol	Value	Unit
Ambient Temperature	T <sub>a</sub>	25±2	°C
Ambient Humidity	H <sub>a</sub>	50±10	%RH
Supply Voltage	V <sub>CC</sub>	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I <sub>L</sub>	6.0	mA
Inverter Driving Frequency	F <sub>L</sub>	55	KHz
Inverter	Sumida-H05-4915		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

### 7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	350	500	-	-	(2), (5)
Response Time		T <sub>R</sub>		-	5	10	ms	(3)
		T <sub>F</sub>		-	11	16	ms	
Central Luminance of White		L <sub>C</sub>		170	200		cd/m <sup>2</sup>	(4), (6)
Average Luminance of White		L <sub>AVE</sub>		155	185	-	cd/m <sup>2</sup>	
White Variation		δW <sub>A</sub>		70	-		%	(5), (6), (7)
		δW <sub>B</sub>		70				
Color Chromaticity	Red	R <sub>x</sub>		Typ.- 0.03	0.597	Typ.+ 0.03	-	(1)
		R <sub>y</sub>			0.336		-	
	Green	G <sub>x</sub>			0.320		-	
		G <sub>y</sub>			0.522		-	
	Blue	B <sub>x</sub>			0.149		-	
		B <sub>y</sub>			0.118		-	
	White	W <sub>x</sub>			0.313		-	
		W <sub>y</sub>			0.329		-	
	Color Gamut		C.G%		42		45	
Viewing Angle	Horizontal	θ <sub>x</sub> +	CR≥10	40	45	-	Deg.	(1)
		θ <sub>x</sub> -		40	45	-		
	Vertical	θ <sub>y</sub> +		15	20	-		
		θ <sub>y</sub> -		40	45	-		

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

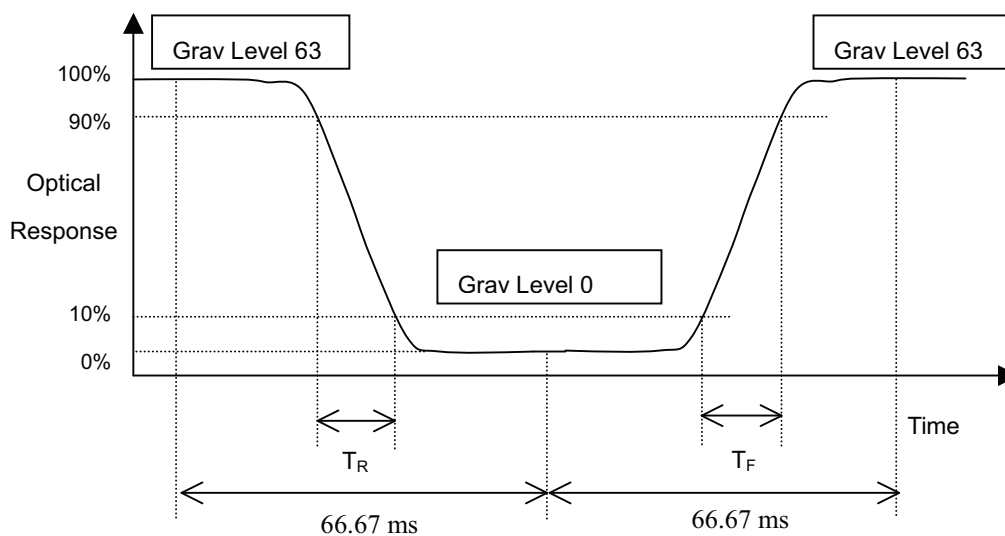
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):



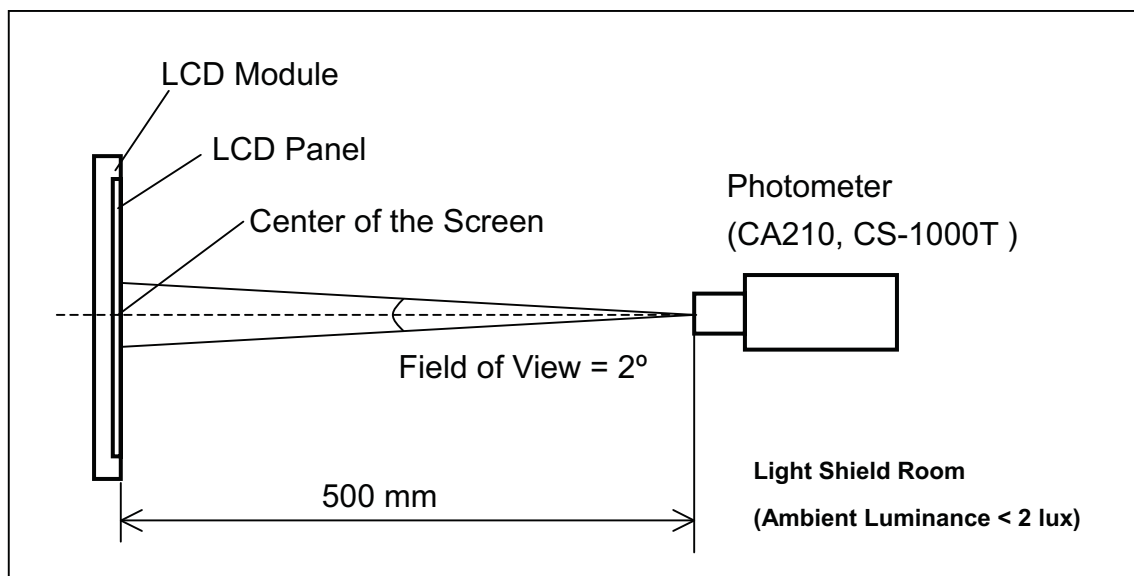
Note (4) Definition of Central Luminance of White ( $L_5$ ):

Measure the luminance of gray level 63 at point X

$L_5 = L(5)$   $L(x)$  is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

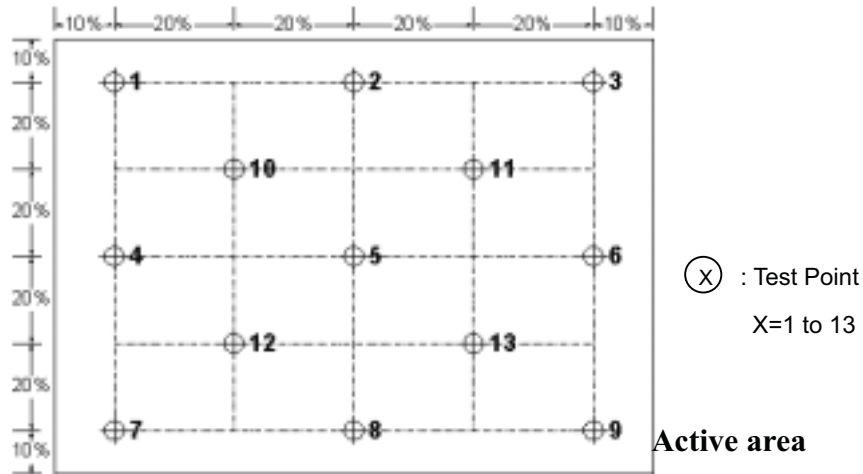
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 63 at 5 points

$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$



Note (7) Definition of White Variation ( $\delta W_A$ ):

Measure the luminance of gray level 63 at any point of range A on active display area

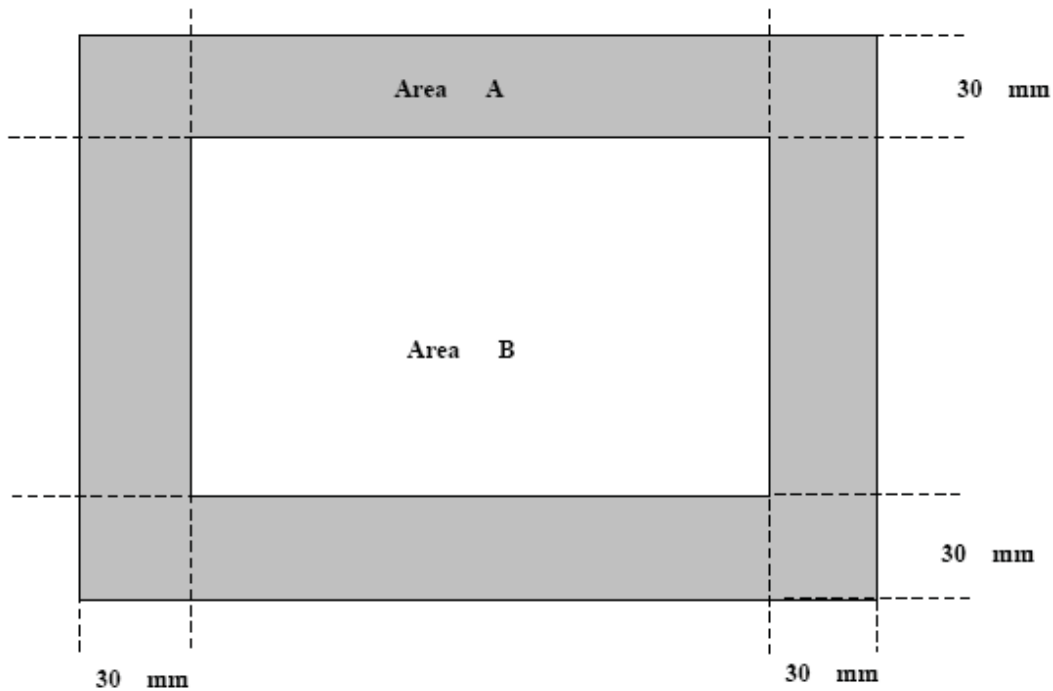
$$\delta W_A = \text{Minimum } [L(\text{Any point of area A})] / \text{Maximum } [L(\text{Any point of area A})] * 100 \%$$

Definition of White Variation ( $\delta W_B$ ):

Measure the luminance of gray level 63 at any point of range B on active display area

$$\delta W_B = \text{Minimum } [L(\text{Any point of area B})] / \text{Maximum } [L(\text{Any point of area B})] * 100 \%$$

$$\delta W_B = \text{Minimum } [L(\text{Any point of area B})] / \text{Maximum } [L(\text{Any point of area B})] * 100 \%$$



Note (8) Definition of color gamut (C.G%):

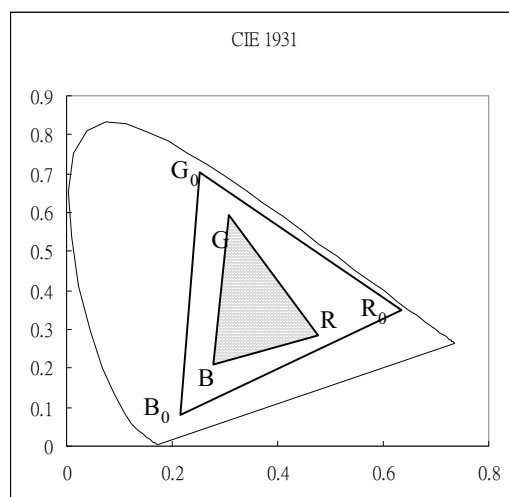
$$C.G\% = \frac{R G B}{R_0 G_0 B_0} \cdot 100\%$$

$R_0, G_0, B_0$ : color coordinates of red, green, and blue defined by NTSC, respectively.

$R, G, B$ : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$ : area of triangle defined by  $R_0, G_0, B_0$

$R G B$ : area of triangle defined by  $R, G, B$



## 8. PRECAUTIONS

### 8.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

### 8.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

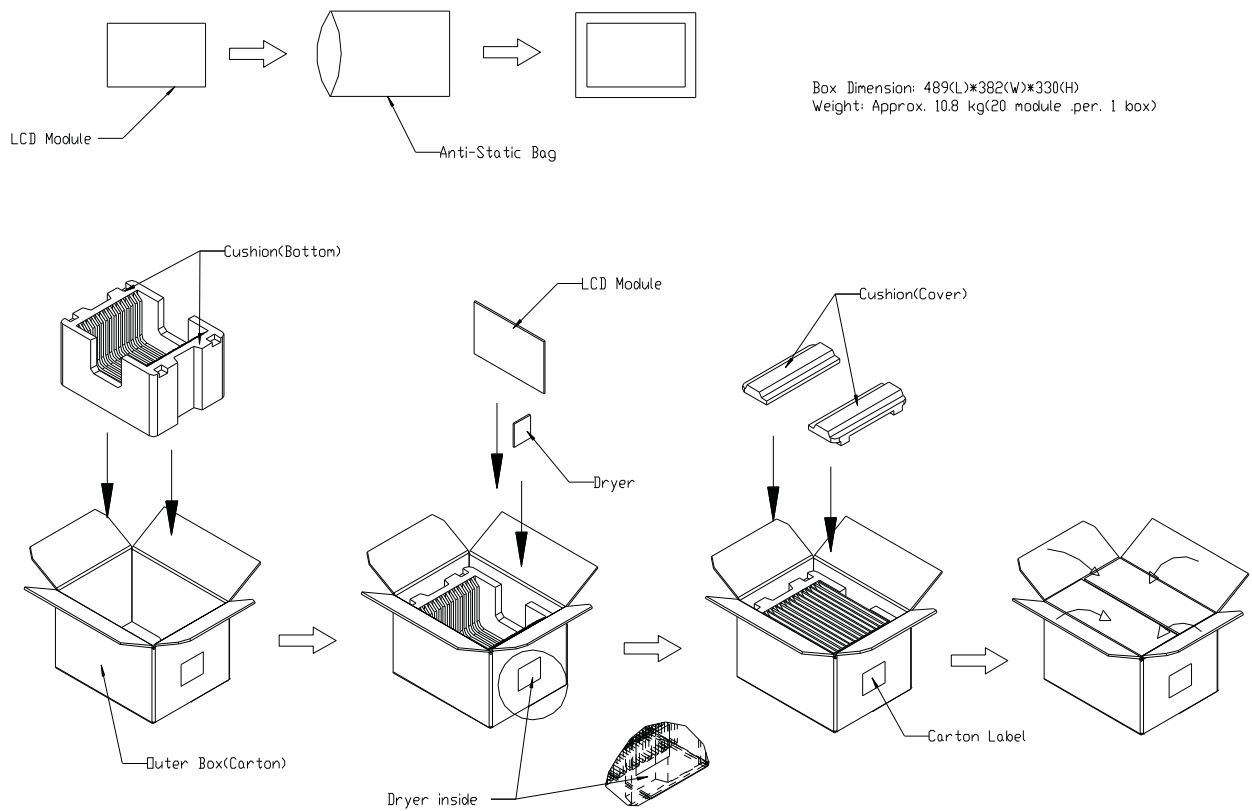
### 8.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.



## 9. PACKING

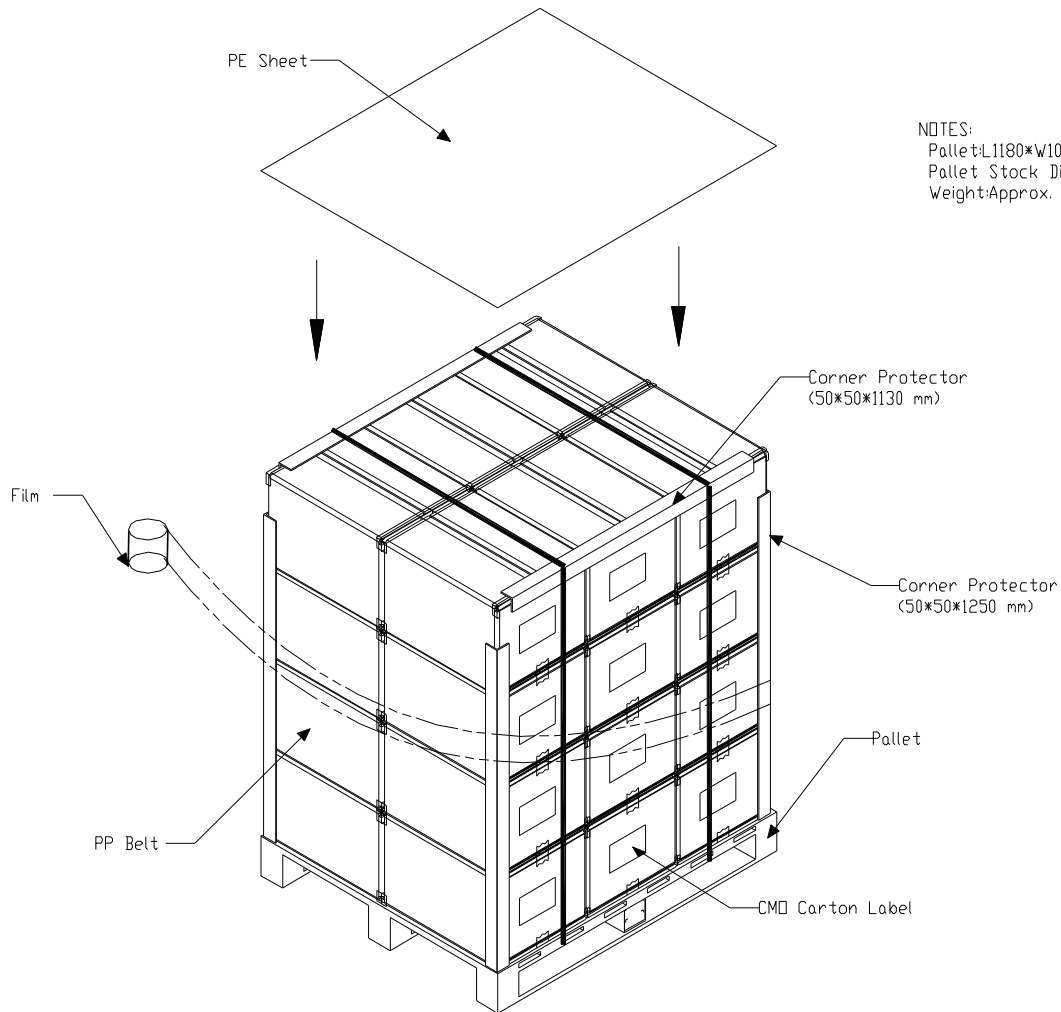
### 9.1 CARTON



#### Packing testing criteria :

- (1) Packing drop : 1 corner, 3 edges, 6 faces, each direction for one time, follow ISTA standard.
- (2) Packing vibration : Random, follow ISTA standard.

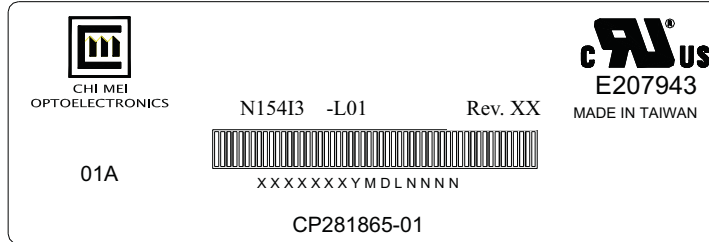
## 9.2 PALLET



## 10. DEFINITION OF LABELS

### 10.1 CMO MODULE LABEL

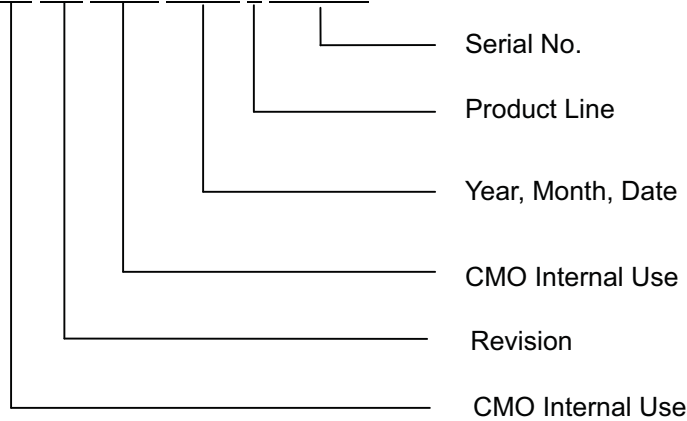
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: N154I3 - L01

(b) Revision: Rev. XX, for example: C1, C2 ...etc.

(c) Serial ID: XX XX XX XX YMDLNNNN



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.


Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10.2 CARTON LABEL

 <b>CHI MEI OPTOELECTRONICS</b>	
PO.NO.	_____
Part ID.	CP281865-01 01A
Model Name	_____
Carton ID.	_____
Quantities	_____



TOLERANCE TABLE	
1-6	$\pm 0.1$
6-30	$\pm 0.15$
30-350	$\pm 0.2$